# Tanning as a substance abuse

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# Tanning as a substance abuse

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**While few people would deny the appeal of a day in the sun there are some who seem to take it too far. In recent years the concept of 'tanning addiction' has become popular and several studies have supported the notion of viewing exposure to UV radiation as a form of substance abuse. In this article we will review some of the literature on sun seeking behavior.**

**Keywords:** Tanning, addiction, Sun seeking, ultraviolet radiation, substance abuse

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Evidence exists for both physiological dependence, characterized by tolerance and withdrawal, and addiction, as modeled on work from the Alcoholism field. In 1992 a multidisciplinary committee of the National Council on alcoholism and Drug Dependence and the American Society of Addiction Medicine defined the hallmarks of Alcoholism as "It (Alcoholism) is characterized by impaired control over drinking, preoccupation with the drug alcohol, use of alcohol despite adverse consequences, and distortions in thinking, most notably denial.."[1] Several studies have used modified Alcoholism surveys to probe tanning addiction.

While the most common source of UV (UV) light is the sun, in recent decades use of indoor tanning parlors has become a significant source of UV exposure. Visits to indoor tanning parlors are easier to quantify than time in the sun, so many studies have focused on indoor tanners. In 2003 a study of non-Hispanic white adolescents in the USA reported that ~28% of female adolescents had used a tanning booth at least 3 times and this percentage increased with age to ~47% in 18 to 19 y old women.[2] A recent meta-analysis of cancer risk from indoor tanning found that indoor tanning, particularly under age 25, is associated with a greater risk of developing both squamous and basal cell carcinoma.[3] The study estimated that greater than 170,000 cases of non-melanoma skin cancer are attributable to indoor tanning each year. Indoor tanning has also been shown to increase risk of melanoma.[4] Despite these serious risks, indoor tanning remains highly popular among young people. These high rates of indoor tanning are likely to be driven in part or initiated by cosmetic desires. Since the early 1900s having a 'tan' has been regarded as a sign of health and prosperity in the Western world.[5] However, given the availability of spray-on tanning products which can substitute the cosmetic results, and the widespread knowledge of the dangers of tanning, could there be another driving factor?

A study in 2005 administered two questionnaires to beach goers, a modified version of the CAGE questionnaire, (originally designed for alcoholism: Cut down, Annoyed, Guilty, Eye-opener), and the American Psychiatric Association's Diagnostic and Statistical Manuel of Mental Disorders criteria for substance abuse, (DMS). From the results of these questionnaires they found that 26% of respondents meet the modified CAGE criteria for substance abuse, responding positively for 2 or more of the addiction hallmarks. 53% meet the DSM criteria responding positively to 3 or more of 7 addiction signs.[6] Similar numbers were found by 2 other studies of college students in the Northeastern USA who reported using indoor tanning facilities, and frequent tanners recruited from tanning salons in Dallas, Texas.[7,8] In the Dallas study the most commonly cited reasons for tanning were 'to look good' (90%), 'to feel good' (69%) and for relaxation (56%), suggesting a subjective and potentially reinforcing response to UV exposure.[7] 27% of respondents answered positively to

needing to spend increasing time tanning to maintain their tan, and 45% to feeling unattractive or anxious to tan if they did not maintain their tan, suggesting tolerance and withdrawal respectively.

Further, respondents who had started tanning at a younger age were more likely to match criteria for a tanning addictive disorder, paralleling other addictions such as alcohol, nicotine and cannabis.[9-11] Given that β endorphin is known to be expressed in the skin, it was speculated that it may be involved in the reinforcing effects. The first data to support endogenous opiates as the mediators of this response came from a small randomized controlled study which exposed 8 frequent and 8 infrequent tanners to either a normal UV tanning bed, or a control tanning bed with no UV.[12] After exposure, participants rated their preference for the particular tanning bed they had used. Frequent tanners showed a stronger preference for the 'real' tanning bed over the one with mock UV than infrequent tanners, though both groups showed some preference. This was repeated with prior administration of naltrexone, a broad opioid antagonist. In both the frequent tanners and infrequent tanners naltrexone reduced the preference for the UV tanning bed. At a moderate naltrexone dose (15mg) 4 of the 8 frequent tanners reported adverse effects resembling opioid withdrawal, (nausea, jitteriness), while none of the infrequent tanners reported adverse effects. Surprisingly, none of the frequent tanners reported adverse effects after a higher naltrexone dose (25 mg). This provides evidence for both a reinforcing opioid mechanism and physiological dependence in response to UV radiation.

While some studies have found increased levels of β-endorphin in the blood of volunteers after UV exposure, results have been mixed.[13-16] Studies in humans are complicated by many variables both between each individual, and from day to day within an individual. Further, these experiments are complicated by the known risks of administering UV. Using mice our laboratory observed that daily sub erythemic UV exposure produced a systemic rise in blood β endorphin levels.[17] Further this increase was physiologically significant and caused analgesia which was absent in β endorphin null mice, or mice lacking skin expression of p53, the upstream regulator of β endorphin in the tanning pathway. Administration of naloxone caused opiate withdrawal symptoms and conditioned place aversion in UV treated mice, but not in mock treated mice, β endorphin null mice or p53 conditional knockouts. We also observed that peripherally administered β endorphin is capable of causing conditioned place preference, suggesting that skin derived β endorphin could have central nervous system effects. While we have only shown this response in mice, other aspects of the UV response and tanning pathways are known to be conserved between mice and humans.

While the putative tanning addiction is clearly not of the same strength as addiction to illicit drugs such as heroin or methamphetamine, this does not render tanning addiction trivial. The FDA estimates that indoor tanning lamps produce over 3000 hospital emergency room visits per year.[18] In a survey of adolescent tanning salon users, 57% reported having experienced burns in the last year.[19] In a survey of frequent tanners 9 out of 100 respondents reported having tried to stop tanning but still continuing, and 6 reported missing a social engagement, work, school or other recreation activity to go tanning.[7] Frighteningly 34% continued tanning despite reporting having had a skin cancer, or having a family history of skin cancer.

These results were mirrored in a recent study where basal cell carcinoma patients with a history of indoor tanning use were contacted 1 to 4 y after treatment and asked about their tanning habits. Of those who responded,15% reported having used indoor tanning within the last year, with a median of 10 sessions in that time.[20] Similar results have also been seen in melanoma survivors. A study in 2012 found that fewer than 50% of melanoma survivors reported regular sunscreen use and sun avoidance, and 10 patients (of 156) reported using tanning beds after being diagnosed with melanoma.[21] Regulation of indoor tanning is currently a controversial topic. While many medical organizations have recommended stricter regulations or an outright ban, these have come up against lobbying by the multibillion dollar tanning industry.[22] The American Academy of Dermatology supports a total ban on non-medical manufacture and sale of indoor tanning technology. While some states in the US have banned commercial indoor tanning for minors, several companies offer home tanning beds. Several studies have shown high rates of non-adherence to existing regulations within the tanning industry. A survey of patron records in North Carolina found that 95% of indoor tanning patrons exceeded the Federal Drug Administration's recommended limits.[23] A study in San Diego found that only 5% of tanning establishments adhered to recommended tanning schedules and all offered 'unlimited' tanning options.[24] Another study, also in San Diego, found that only 43% of tanning establishments complied with parental consent regulations.[25] While UV exposure is a source of Vitamin D, readily available supplements and fortified foods mean UV is no longer a necessity. Tanning would certainly not be the first behavior to have been recommended for its health benefits before being known to be addictive as well as carcinogenic.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.


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